

CONSERVING ARKANSAS KARST SPECIES AND HABITATS.

Project Summary

This project addresses the 2015 State Wildlife Grant funding karst priority “Address data gap needs for species in order to develop conservation actions” for karst species that occur in northwest Arkansas and the crayfish priority “Determine distribution, abundance, landscape-level habitat, and genetic status of Bristly Cave Crayfish, *Cambarus setosus*, in Arkansas”. The project also addresses the habitat priority “Restore and maintain naive terrestrial habitats in karst recharge zones” by focusing on best management practice implementation in recharge zones found in northwest Arkansas and native vegetation improvement activities at Foushee Cave and Cave Springs Cave natural areas.

Project Leader

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Project Partners

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SWG Funding Requested: \$98,100 (32%)

Amount and Source of Matching Funds: \$204,200 (68%) of non-federal match will be provided from Arkansas Department of Environmental Quality and Arkansas Natural Heritage Commission

Total Project Costs: \$302,300

NEED: Karst is a terrain, generally underlain by limestone or dolomite, in which the topography is chiefly formed by the dissolving of rock, and which may be characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, and caves. Because light is absent and food limited, many species exhibit morphological, physiological, and behavioral characteristics that make them well suited for existence in subterranean habitats. These organisms are important components of species conservation planning efforts outlined in the Arkansas Wildlife Action Plan (AWAP).

The protection of karst-dependent species is problematic because their habitat has been degraded or lost due to a number of environmental threats. Though the primary threat of habitat loss due to land development is observable and obvious to many people, there are other important threats such as hydrological alteration, nutrient stress, nutrient loss, sedimentation, temperature change, enrichment, chemical pollution, isolation, and the killing and disturbance of the species. The result is that many karst-dependent species have experienced sharp population declines and are now federally listed as threatened or endangered or considered Arkansas species of greatest conservation need (SGCN).

High-quality examples of karst ecosystems occur across northern Arkansas, and some of these systems receive protection through their inclusion as part of state natural areas. For example, Foushee Cave Natural Area, located in Independence County, features one of the most biologically significant caves in Arkansas and a diversity of geology and landforms that support pine, pine-hardwood, and hardwood forests and woodlands along the full gradient of slopes and aspects. Deep forested ravines along perennial streams provide excellent foraging habitat for Gray Bats (*Myotis grisescens*) and Indiana Bats (*Myotis sodalis*). Cave Springs Cave, part of Cave Springs Cave Natural Area in Benton County, is essentially a long “solution channel” formed by a groundwater-fed stream. The cave provides habitat for several karst SGCN (*Caecidotea stiladactyla*, *Eurycea spelaea*, and *Hesperochernes occidentalis*) in addition to hosting the largest known population of the Ozark Cavefish (*Troglichthys rosae*) and a maternity colony of Gray Bats.

Yet, even at these protected sites, threats from historic or current habitat alteration may limit the successful use of these areas by SGCN. Loss of forest cover at Foushee Cave Natural Area reduces foraging habitat for bats and limits riparian buffering of water that flows to the White River. Invasive species encroachment from properties adjacent to Cave Springs Cave Natural Area creates monocultures of plants on the natural area that reduce the diversity of prey for foraging bats and may alter the environment (e.g. humidity) of locally occurring subterranean microhabitats which contain karst SGCN. Improving native terrestrial habitat for karst SGCN was identified as a priority by the 2015 AWAP Steering committee.

A previous Arkansas State Wildlife Grant (T20-9) assessed threats associated with karst SGCN, and the project identified that most SGCN populations were threatened with human disturbance and habitat degradation. Threats to these species were more severe in northwest Arkansas due to rapid urbanization. The 2015 AWAP Steering committee recognized that urbanization may have deleterious impacts to populations of karst species found in northwest Arkansas (Table 1), and that these species were in need of additional conservation efforts. Two focus areas for conservation actions were identified: 1.) addressing basic data gaps such as baseline abundance, habitat quality, and habitat delineation, and 2.) implementing best management practices or BMPs that would benefit these species.

The Steering committee also identified a specific interest to better understand the distribution and genetic status of the Bristly Cave Crayfish (*Cambarus setosus*), a cave species with a disjunct distribution in the state. Several populations of the crayfish occur in northwest Arkansas adjacent to the main species range which occurs in southwest Missouri. A third Arkansas site for this cave crayfish has been identified near Batesville; however, the distance between northwest Arkansas and Batesville populations suggests a more detailed analysis is needed. Because the Bristly Cave Crayfish occurs in northwest Arkansas, there is significant overlap between the northwest Arkansas karst species priority and the crayfish priority identified by the Steering Committee. Therefore, these two priorities will be addressed as one.

PURPOSE AND OBJECTIVES: The primary goals of this project are to improve terrestrial habitats for karst SGCN at Foushee Cave and Cave Springs Cave natural areas, address data gaps and implement

BMPs for karst SGCN in northwest Arkansas, and determine the distribution and genetic status of the Bristly Cave Crayfish. Project completion will take two years; proposal objectives are:

1. Increase the scale of high-quality karst native terrestrial habitat through invasive plant species control and afforestation to benefit SGCN.
2. Increase protection of northwest Arkansas karst SGCN through addressing data gaps and BMP implementation.
3. Determine relationship between Arkansas populations of Bristly Cave Crayfish.

LOCATION OF WORK: This project will be conducted within portions of the Ozark Highlands ecoregion (mainly in northwest Arkansas and Independence County), within the Ozark Highlands - Arkansas River eco-basin.

APPROACH:

Objective 1. At Foushee Cave Natural Area prior to tree planting, the site will be treated with herbicide to greatly reduce invasive plant species. Photo points will be established to document progress. A contractor will then plant seedlings with oversight by Arkansas Natural Heritage Commission (ANHC) staff. Approximately one year post-planting, ANHC staff will perform a survivability survey to determine the percentage of live seedlings (80% survival goal). At Cave Springs Cave Natural Area, management efforts will focus on the mechanical removal of an infestation of Winter Creeper (herbicide application is prohibited due to karst feature locations) and other invansive plant species.

Objective 2. Based on information available from the ANHC Element Occurrence Records database, a list of caves in northwest Arkansas that provide habitat for karst SGCN will be developed. The list will be prioritized based on several metrics that will include number of SGCN present, availability of recent information on species abundance and habitat quality, and association with an Ecologically Sensitive Waterbody (APCEC Reg. 2.302). Populations of karst SGCN at the top-ranked 10 sites will be assessed to establish a baseline.

Methodology will be species dependent (e.g. bait stations, quadrats, timed area searches, or visual surveys).

Water quality monitoring will be conducted by collecting monthly surface grab samples at the cave mouth. Samples will be routinely analyzed for a suite of chemical parameters including: dissolved oxygen, nutrients, pH, turbidity, organics, and minerals. Every other

month, samples will also be analyzed for total and dissolved metals. Each site will be assessed for localized impact (e.g. trash, vandalism, timing and frequency of illegal visitation), and a preliminary estimate of contributing surface lands (subsurface watershed estimate) will be determined. Recharge delineations will likely not be necessary or feasible at all sites. Therefore, recharge delineations will only be conducted at the top two sites. Delineations will be conducted using standard dye tracing techniques as outlined in Arkansas State Wildlife Grant T30-8 which delineated the recharge area for Foushee Cave.

Table 1. Arkansas Karst SGCN. AWAP priority score is in parenthesis.

Class	Common Name	Scientific Name
Amphibians	Grotto Salamander (19)	<i>Eurycea spelaea</i>
Crayfish	Bristly Cave Crayfish (27)	<i>Cambarus setosus</i>
Fish	Ozark cavefish (34)	<i>Rhadine ozarkensis</i>
Invertebrates Other	cave obligate millipede (65)	<i>Trigenotyla parca</i>
	isopod (57)	<i>Caecidotea macropropoda</i>
	Shelled Cave Springtail (42)	<i>Pseudosinella testa</i>
	isopod (42)	<i>Caecidotea simulator</i>
	cave obligate planarian (42)	<i>Dendrocoelopsis americana</i>
	isopod (30)	<i>Caecidotea ancyla</i>
	isopod (30)	<i>Caecidotea steevesi</i>
Mammals	Ozark Cave Amphipod (27)	<i>Stygobromus ozarkensis</i>
	springtail (25)	<i>Pygmarrhopalites clarus</i>
	pseudoscorpion (23)	<i>Hesperochernes occidentalis</i>
Mammals	Indiana Bat (46)	<i>Myotis sodalis</i>
	Gray Bat (23)	<i>Myotis grisescens</i>

Land parcel information from recent plat books will be georeferenced, using ArcGIS 9.3 to identify all landowners with property within the contributing areas for these caves. Landowners will then be contacted to promote protection, restoration, and determine willingness to participate in conservation efforts. Based on this information, a prioritized list of sites and recommended actions will be developed and implementation of conservation actions will begin at several of the sites. A best management practices manual for karst landscapes is currently being developed for northwest Arkansas, and this manual will provide the basis of recommendations. Implementation of conservation activities during this project will serve as demonstrations of available techniques and facilitate the development of future proposals to fund high-priority actions.

Objective 3. The three Bristly Cave Crayfish sites will be revisited to census cave crayfish populations. To determine the genetic status, a single walking leg will be removed from up to five individuals from each site and preserved in 100% ETOH. Samples will be analyzed in collaboration with Jeff Koppleman (Resource Scientist, Missouri Department of Conservation). Genetic material will be collected with assistance of AGFC and USFWS staff to ensure all federal and state collection regulations are followed.

EXPECTED RESULTS AND BENEFITS: Restoring native karst terrestrial habitat at Foushee Cave and Cave Springs Cave natural areas will (1) create additional high-quality habitat for karst SGCN, (2) provide connectivity by restoring degraded habitat adjacent to existing high-quality habitat and in newly acquired areas, (3) improve the water quality of the White River for aquatic SGCN, and (4) increase the scale of managed land, thereby providing a larger landscape to benefit SGCN and other wildlife. Assessing the status of SGCN populations at the 10 priority sites in northwest Arkansas will assist in determining how likely conservation at individual sites is expected to benefit species and will generate a baseline for comparison. Water quality information will allow sites to be compared to historic information, will establish a baseline for future comparisons, and will provide insight on potential stressors impacting aquatic and semi-aquatic SGCN. Determining the distribution and genetic status of the Bristly Cave Crayfish will reduce data gaps associated with the species and facilitate habitat conservation. Identification of landowners, tracts, and landowner interest in conservation activities will assist with developing a prioritized list of implementation sites. The outcome for this project will be a plan that sets priorities for habitat protection and restoration and will provide a solid foundation for implementing voluntary conservation actions, targeting funds available through other avenues, and highlighting future funding priorities for these species at these sites.

BUDGET: The total cost of this project is \$302,300.

32% Award - 68% Match	Requested SWG Funds	ADEQ Match	ANHC Match	Total
Personnel & Fringe	\$ 22,195			\$ 22,195
Operating Expenses				
Travel	\$ 2,800			\$ 2,900
Supplies	\$ 3,400		\$ 1,500	\$ 5,000
Recharge/restoration contracts	\$ 51,500		\$ 21,500	\$ 73,000
Water quality analyses		\$ 181,200		\$ 181,200
Miscellaneous expenses	\$ 200			
Indirect Costs*	\$ 18,005			\$ 18,005
<i>Subtotal</i>	\$ 98,100	\$ 181,200	\$ 23,000	\$ 302,300
TOTAL		\$ 302,300.00		

*TNC's negotiates its indirect rate annually with the U.S. Fish and Wildlife Service. The proposed negotiated indirect cost rate starting July 1, 2015 is 21.75%.

ORGANIZATION AND STAFF QUALIFICATIONS

TNC, ANHC, ADEQ, USFWS, and AGFC have worked together for several decades to address habitat conservation, species protection, and water quality protection in the Ozark Karst Ecosystem. These agencies have worked together at a landscape scale to aid in the recovery of karst-dependent animal species and their habitats spanning across state boundaries into Oklahoma and Missouri.

Michael Slay is the Ozark Karst Program Director for The Nature Conservancy. Since joining The Nature Conservancy, Mike has worked closely with US Fish and Wildlife Service, US Forest Service, Arkansas Game and Fish Commission, Missouri Department of Conservation, Oklahoma Biological Survey, and Illinois Natural History Survey to conserve and protect karst species and habitats. Mike received his undergraduate degree and M.S. in Biology at the University of Arkansas, and he has authored more than 25 peer-reviewed journal articles related to the discovery and conservation of karst species.

Bryan Rugar is the Chief of Land Acquisition and Stewardship for the Arkansas Natural Heritage Commission. Bryan received a B.S. in natural resource management from Grand Valley State University and a M.S. in forest resource management from the University of Arkansas at Monticello. Bryan previously worked for the US Forest Service in Michigan and as a consulting forester in southern Arkansas. Bryan oversees all acquisition projects for the commission, and has closed on 31 properties, adding over 11,000 acres to the System of Natural Areas.

Jason Throneberry is the Aquatic Ecologist for the Arkansas Natural Heritage Commission. Jason received a B.S. in Fisheries and Wildlife Biology from Arkansas Tech University and a M.S. in Biology from Tennessee Technological University. Since starting with ANHC, he has worked with many agencies and organizations to survey and maintain records of rare and/or endemic aquatic species. Recently, Jason and a panel of experts have reviewed all fish species in Arkansas and assigned state conservation ranks, which will be used by conservation agencies for future conservation planning.

Brian Wagner is Interim Assistant Chief/Nongame Aquatics Biologist with the Arkansas Game and Fish Commission. He has a M.S. Degree in Fisheries from Virginia Tech, and has been involved in aquatic conservation and research with the Commission for 26 years. For the past 17 years, he has been the Commission's Nongame Aquatics Biologist. He is a Certified Fisheries Scientist and has authored or co-authored peer-reviewed publications on sport fish, nongame fish, crayfish, reptiles, and amphibians.

Mitch Wine serves as the Karst and Cave Biologist for the U.S. Fish and Wildlife Service (Service) and has been employed by the Service since 2003. Previous duties with the Service include tail-water aquaculture at Greers Ferry National Fish Hatchery and as the Service Liaison to the Federal Highway Administration. Mitch has a B.S. in Zoology and M.S. in Biology from Arkansas State University. Mitch has co-authored one scientific research publication and multiple technical documents targeting listing and recovery of threatened and endangered species in Arkansas.

Jessie J. Green is an Aquatic Ecologist for Arkansas Department of Environmental Quality and received both B.S. and M.S. in Biology from Arkansas State University and University of Central Arkansas, respectively. Jessie's research interests have focused on effects of anthropogenic land use changes to aquatic ecosystems by analyzing population and community level responses to habitat stressors.

Tate Wentz is the Aquatic Ecologist Coordinator for Arkansas Department of Environmental Quality. He has a B.S. in Fisheries and Wildlife Biology and M.S. in Biology from Arkansas Tech University. Tate has worked at ADEQ for seven years as an aquatic ecologist and researched a variety of topics from efficacy of habitat restoration to the long-term effects of major ions in wadeable streams.